

Contract Energy Management Guide: for building managers and occupiers

Introduction

Energy is one of the most significant and most easily controllable overheads in many organisations. Unlike the returns on many forms of investment, savings in energy costs translate directly into reduced operating costs and increased profit. Implementing energy efficiency measures may also lead to an improvement in working conditions, with possible benefits in staff productivity. In addition, burning of fossil fuels causes environmental damage through actions such as acid rain and the greenhouse effect. Energy efficiency is a cost-effective means of reducing these problems.

Opportunities exist for improving energy efficiency in all types of building. On average, cost-effective savings of about 20% are achievable, without affecting the level of service provided.

To improve energy efficiency, an organisation needs to identify opportunities, recommend cost-effective measures, implement the measures, and be vigilant in maintaining the improved standards. This requires expertise and financial resources, together with management commitment. Constraints on either of these factors will act as a barrier to the implementation of energy efficiency improvements. In such cases Contract Energy Management (CEM) is a possible method of making the required resources available to realise the achievable savings.

Contract Energy Management is the generic name for a broad range of services offered by a variety of companies in the UK. In general, it involves an arrangement under which an outside company provides the finance and expertise for energy efficiency investments in a client organisation. The resulting savings are shared between the client and the contractor, with the contractor using his share to pay for the investment. Although the name is relatively new, some companies in the industry have been in business for over twenty years.



Detailed guidance on the steps involved in setting up and running a CEM contract is contained in an Applications Manual on Contract Energy Management, published by the Chartered Institution of Building Services Engineers (CIBSE). Preparation of the document has been sponsored by the Energy Efficiency Office of the Department of the Environment, through BRECSU.

The Applications Manual "Contract Energy Management" is an essential reference document for energy managers, facilities managers and others responsible for managing energy consumption in buildings.

Applicable to industrial, commercial and public sector buildings, this is a definitive guide for those contemplating the use of CEM services.

Copies of the Applications Manual can be purchased from:

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London
SW12 9BS
Telephone: 081 675 5211
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ENERGY EFFICIENCY

“CEM is one route to improved energy efficiency”

ROUTES TO ENERGY EFFICIENCY

Routes to Energy Efficiency

Various routes are available to achieve and sustain increased energy efficiency according to the availability of management, technical expertise and finance. The decision tree (figure 1) giving routes to energy efficiency shows how choices may be made between the different options.

An organisation may decide to carry out its own survey and implement energy efficiency measures using its own finance and energy resources. Alternatively, consultants may be used to provide specialist advice, and the client then pays for the recommended energy efficiency investments and manages energy use thereafter. In some other cases, it may be most appropriate to use an external contractor to provide both expertise and finance; in other words, to take the Contract Energy Management route. The CEM company would take over responsibility for running the site energy services in the most cost-effective manner, leaving the user to concentrate on other aspects of his business.

The advantages of using Contract Energy Management to improve energy efficiency are that:

- the contractor has expertise in the specification, purchase, installation, operation, management, control and maintenance of equipment, leading to reduced costs
- the contractor raises the necessary capital finance for investment
- the contractor carries the risk in implementing his energy survey recommendations
- the contractor frees the client from having to manage his energy use, allowing him to concentrate on his main business.

However, a substantial level of involvement and technical expertise is required from potential users of CEM services. Where CEM is identified as a suitable option, the success of a contract will be influenced greatly by the degree of preparatory work undertaken by the user. The user needs to consider the level of service required, decide on the most appropriate type of contract, and investigate any possible problems. The user also needs to be able to monitor the performance of the CEM contractor once the contract is running.

Types of Contract

CEM companies offer energy management services in a number of different ways. The emphasis may be on the energy demand side or may tend towards the supply side according to the requirements of a site and the needs of the client. The different services can be categorised according to the type of contract used by the CEM company to recover its investment:

- heat service contract, in which variable charges are levied according to the energy supplied to the site
- shared savings contract, in which charges are based on energy savings achieved
- fixed fee contract, in which charges are based on the level of services provided.

Contracts also exist in which a heat service is provided without capital investment. These are not considered in the CIBSE Applications Manual.

The Manual contains a detailed analysis of the three main types of contract, describing individual characteristics and commercial features and providing advice to potential clients on which type of contract to select. Special considerations pertaining to three major sectors – public, industrial and commercial – are addressed individually. The Manual thus enables readers to prepare for a CEM contract, take a view on the level of service and commercial arrangements that would suit them best and consider any difficulties that their own circumstances might provoke.

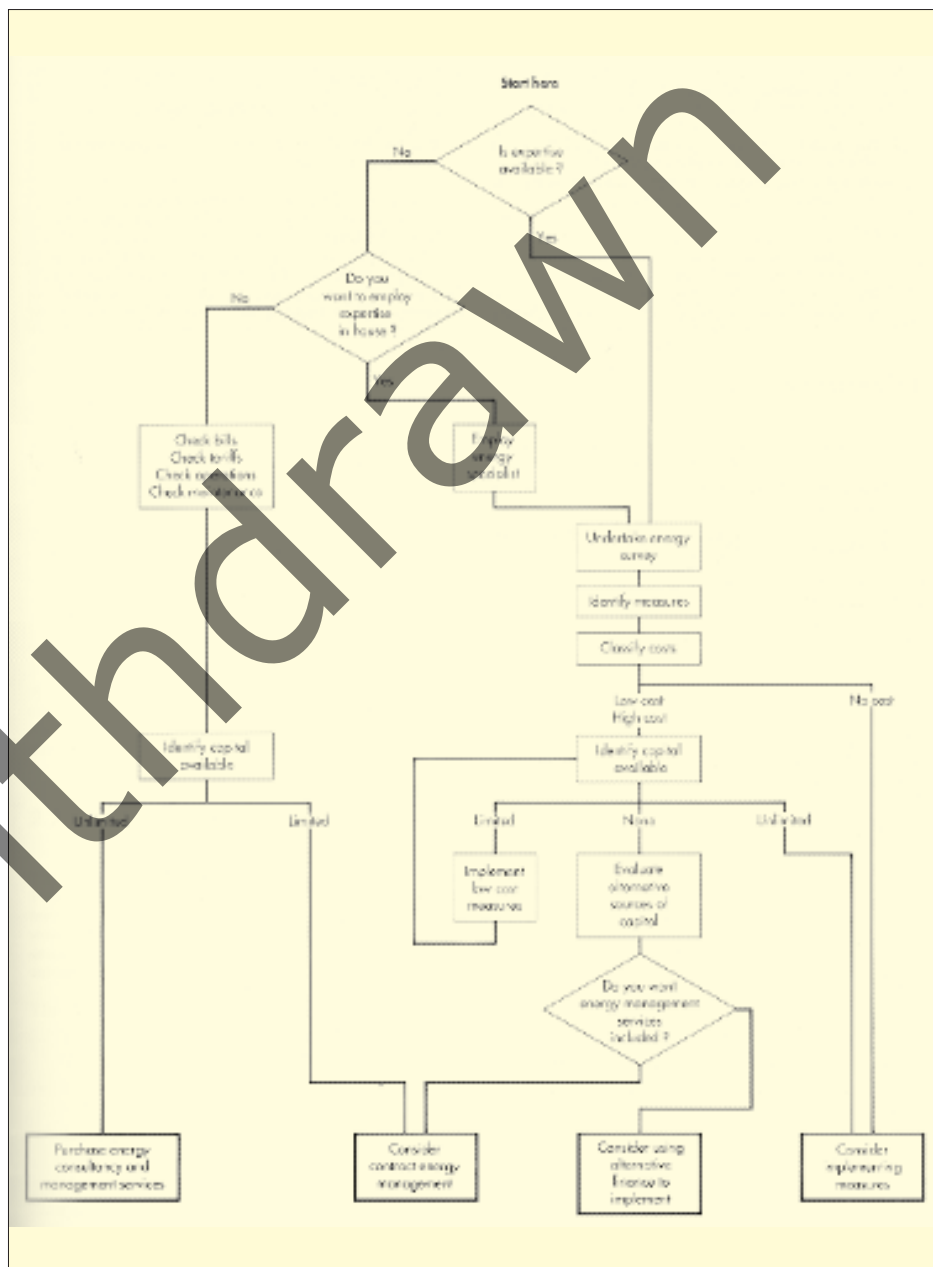


Figure 1 Routes to energy efficiency

Case Studies

Some examples of buildings where CEM has been successfully used to improve efficiency.

Industrial Site

A large industrial site producing automotive components, where energy supply is covered by a 10-year shared savings type contract with a CEM company. Prior to the start of the contract, the site heating was provided by a centralised system which had a poor level of reliability. Investment measures undertaken by the CEM company include:

- a new gas-fired warm air and radiant tube system for space heating
- dedicated local gas-fired boilers for office heating and domestic hot water
- gas-fired immersion tubes for spray washers and dunk tanks
- new direct-fired drying ovens and local steam generators for process
- a Building Energy Management System (BEMS) linked to the CEM company's main system.

After completion of these changes heating energy consumption was reduced by over 40% giving a cost saving of £500 000 per year. An additional saving of over £50 000 per year resulted from reduced maintenance costs.



Automotive products production site



Quadrant House

Quadrant House, Surrey

Quadrant House, a large air-conditioned office building in Surrey which is the headquarters of Reed Business Publishing Group, who entered into a CEM contract in 1987. The contractor has taken charge of the plant operation, maintenance, repairs,

replacements, fuel purchasing and the achievement of specified environmental standards. The investment measures include the installation of new burners on the boilers and the replacement of the Building Energy Management System and related controls. Between 1985/86 and 1988/89, the gas consumption was reduced by two-thirds, with two main areas of saving:

- controlling the central air-handling plant to minimise the need for additional heating or cooling by local heat pumps
- eliminating inefficient use of boilers in summer by heating hot water for catering and toilets electrically.

Just before the contract started, lighting controls were improved; the improved control of plant and lighting resulted in a cut in electricity consumption of 15% despite the growth in electronic office equipment and summer-time electric hot water heating.

Residential Flats, North London

A block of residential flats situated in North London where the Residents Association management company entered a 7-year fixed fee/shared savings type contract with a CEM company.

The CEM company invested in these items:

- replacement of the existing oil-fired boilers with high efficiency gas-fired boilers
- new calorifiers for domestic hot water

- a Building Energy Management System (BEMS), linked to the CEM company's host computer.

Following refurbishment the calculated saving on the first year's energy bill was 40%, in addition to a reduction in the tenants' maintenance charge.



Residential Flats, North London

Scope of Services Offered Under CEM

The CIBSE Applications Manual describes the scope of services available from and essential features of CEM.

The CEM contract is based on the energy savings plan, which involves the choice of buildings and building services to be included and a feasibility study to determine the energy savings measures to be installed. The potential CEM user will need to decide on the level of service to be required from the contractor.

Services provided by the contractor may include:

- finance to pay for investments made during the project
- installation of equipment to meet conditions for acceptance by the client
- operation and maintenance of plant, either by the client's staff or by the contractor
- monitoring of energy use and equipment performance
- control of environmental conditions within limits agreed with the client
- additional services, such as fire and security monitoring.

Stages in a CEM Contract

The initiation, operation and ultimate termination of a CEM contract involves a number of distinct steps. For some users the procedure can be kept relatively simple, but for those demanding a formal approach, the steps can include:

- invitation to provide CEM services
- invitation to submit first stage proposal
- preliminary study
- first stage proposal
- invitation to submit second stage proposal
- feasibility study
- proposal evaluation.

A number of CEM companies can be invited to provide CEM services; from these a small number, usually three, are asked to submit a first stage proposal. At this stage, the CEM company undertakes a preliminary survey of the site at its own expense, and produces a proposal which gives an estimate of the total proposed investment and energy savings, plus details of the proposed contract. The user then selects one company to proceed with a second stage proposal. The selected CEM company undertakes a full feasibility survey (for which the client usually pays) and submits detailed proposals and costings. The user evaluates the proposals and enters into negotiation on the final form of the contract and scheme.

All steps of this formal approach, known as two-stage tendering, are discussed in detail in the Manual. The points at which the user incurs financial commitment are clearly identified and further guidance is offered on operation and management of a contract and its termination.

A typical timing plan for implementation of a CEM contract is also given in the manual.

Evaluation of CEM Contracts

To evaluate a CEM proposal the user needs to apply a range of analysis and decision making techniques. The evaluation of first and second stage proposals require different approaches.

The first stage proposal should be subjected both to financial and non-financial appraisal. Second stage proposals require a more qualitative assessment. The CIBSE Manual offers detailed guidance on evaluation of the energy efficiency plan and the proposed contract, including such items as:

- proposed energy efficiency measures
- basis for calculation of savings
- timetable for implementation
- contract duration
- installation standards
- operation and maintenance
- base year assumptions
- changes to service levels
- methods for calculating payments
- escalation clauses.

Once the plan and contract are found to be acceptable, it is recommended that the user should make a final decision between CEM and full implementation using in-house resources.

Presenting the Case for CEM

No scheme, least of all a CEM scheme, will be accepted by senior management unless presented in a structured, well thought out manner. The case for using CEM as opposed to in-house resources must be put forward with clarity and confidence. The financial appraisal of alternatives forms the heart of the case and should be based on sound investment analysis techniques.

Calculation Techniques for Evaluating Savings

Calculation of the savings resulting from a CEM scheme is a critically important process, particularly for shared savings contracts. The procedures for calculating charges or savings depend on the contract type, the site and the abilities and preferences of the user. To take into account the effects of variables outside the control of the CEM contractor, energy consumption data is usually normalised.

Variables which affect energy use include:

- ambient temperature
- occupancy
- hours of use
- internal temperature
- process output.

As these variables change from year to year, so they affect the level of energy used. This must be accounted for when assessing the energy savings achieved by the CEM contractor. For example, in a mild winter,

energy used for heating will fall, while it will go up in a cold winter. Adjusting the energy consumption figures to account for this variation is known as normalisation.

A decision tree can be used to select which normalisation option to use:

- neglect normalisation
- use approximate methods
- use statistical analysis.

The necessary steps for each option are described in detail in the CIBSE Applications Manual. Approximate methods can be carried out using normalisation worksheets, which offer a step by step route to prediction of energy consumption using simple rule of thumb adjustment methods to account for variation in the relevant factors.

A more rigorous approach to normalisation of consumption statistics can be undertaken using the techniques of statistical analysis. This requires analysis of the effects of independent variables using regression techniques. For one or two independent variables, hand calculations or graphical methods may be employed and these are described in detail in the Applications Manual. Alternatively, the calculations may be performed using computer software packages.

Having carried out the normalisation process, the energy savings achieved in each year of a contract can be calculated from the difference between actual energy consumption and the predicted energy consumption which would have occurred if the energy systems had been left unchanged. Multiplying the energy savings by the appropriate energy supply tariffs will give the total energy cost savings. A thorough evaluation will need to take account of factors such as:

- reduction in electrical maximum demand
- change in step charges due to the above
- savings due to power factor improvement
- step changes in scheduled gas price
- savings due to change in energy source.

The cost savings due to non-energy factors such as reduced operation and maintenance costs should be added to the energy cost savings to determine the total savings.

Summary

CEM is one route to improved energy efficiency. It offers particular benefits to organisations which are constrained by either lack of capital to finance energy efficiency improvements, or a shortage of management time and expertise to identify and implement energy efficiency measures and attain the realisable savings. Where CEM is identified as a possible option, the client will need to be sure that he can negotiate the best possible type of contract to suit his circumstances. Comprehensive guidance on setting up and managing contracts is contained in the CIBSE Applications Manual.